(4) Four of the prevailing seiches, or free oscillations under the influence of inertia, on Lake Erie and Lake Michigan-Huron have been isolated. Their periods and probable methods of oscillation have been shown. The relation between these seiches and the uncertainties in daily mean elevations of the water surface at gage stations has been discerned. The appreciation of this relation aids decidedly in obtaining accurate determinations of the daily mean elevation of the mean surface of each lake.

(5) The accuracy with which the elevation of the mean surface of any one of the Great Lakes may be determined for any given day has been decidedly increased. On Lake Erie the elevation of the mean surface of the lake may now be determined as accurately from 1 day of observation at Buffalo as it was formerly possible to fix it from 16 days of observation at that station. Similarly, the elevation of the mean surface of Lake Michigan-Huron may now be determined as accurately from 1 day of observation at Mackinaw as it was formerly possible to determine it from 6 days of observation at that station. When one determines the fluctuation of elevation of the mean surface of a lake he thereby determines the fluctuation in the total water content of the lake.

(6) The relations of the new knowledge indicated in (1) to (5) to four outstanding problems have become evident. The four problems are:

(*a*) The problem of regulating the elevations of the water surface of each of the Great Lakes—and the rates of flow through the connecting streams, so as to secure the greatest aggregate benefits to navigation, power, development, and sanitation.

(*b*) The problem of determining the laws of evaporation from large free-water surfaces such as the surface of the Great Lakes.

(*c*) The problem of correcting the observed elevations of the water surface at a tide gage in such a manner as to remove the disturbances due to winds and fluctuating barometric pressures and thereby to secure a more accurate determination of mean sea level than could otherwise be obtained from said observations.

(*d*) The problem of determining the direction and rate of the tilting, which is believed to be in progress, of the land underlying and immediately surrounding the Great Lakes.

As to the accuracy of the results, the author considers it possible to determine the mean elevation of the whole of Lake Michigan-Huron, for example on any day, with a probable error of less than ± 0.010 foot, and that by using the three stations Milwaukee, Mackinaw, and Harbor Beach it would appear that the change in elevation of the mean surface of the whole lake for any one day may possibly be determined with a probable error of less than ± 0.007 foot—an accuracy hitherto unattainable.

NOTES, ABSTRACTS, AND REVIEWS.

Anton D. Udden (1886-1922).

On September 5, 1922, occurred the death of Dr. Anton D. Udden, at San Antonio, Tex. To those who were privileged to be associated with Doctor Udden, even for a short time, the news of his untimely death will be accepted with deepest regret.

It was not until 1917 that Doctor Udden's interest in meteorology was brought to the attention of the Weather Bureau, although he had taught meteorology, among other sciences, at Augustana College, Rock Island, Ill., for a number of years, and had completed most of the work required for the degree of Doctor of Philosophy in the University of Chicago. On January 1, 1918, he entered the service of the Weather Bureau as an observer at Davenport, Iowa; plans for undertaking research work at the Central Office in Washington were annulled by the induction of Doctor Udden into the military service on April 14, 1918, after only three and one-half months at the Davenport station. He was among the first of those selected by the Signal Corps to receive instruction in meteorology at College Station, Tex. Upon completing work in this school, Doctor Udden was assigned to Washington, D. C., and to the meteorological station at Cape May, N. J. Upon the completion of his military service, he resigned from the Weather Bureau to continue his work as instructor in physics at the University of Pennsylvania in Philadelphia. He was appointed McFadden Fellow of the American-Scandinavian Foundation and spent his last two years in study at the University of Copenhagen with Professor Bohr. His strenuous academic activities abroad culminated in a nervous collapse just as he was about to return to the United States. After receiving treatment during the summer in Christiania, he was brought by his wife and father to Texas late in August. His death from heart failure occurred only 11 days after arriving in the United States.

Doctor Udden's quiet demeanor, his modesty, his great capacity for work and study which revealed itself rather by his accomplishments than by brilliant display of knowledge, his genial disposition which remained placid under military circumstances ordinarily capable of irritating one of his attainments, his willingness to undertake commonplace tasks,—all are qualities which impressed his superiors and stimulated his fellows.

The publication of an article prepared by Doctor Udden is contemplated for an early number of the MONTHLY WEATHER REVIEW.—*C. L. M.*

Ştefan C. Hepites (1851-1922).

Notice has been received of the death of the first director of the Central Meteorological Institute of Roumania, Ştefan C. Hepites, at Braila, September 15, 1922, at the age of 71 years. Doctor Hepites was the organizer of the Roumanian Institute and devoted his life to researches in meteorology and other branches of geophysics.

The notice, signed by the present director, E. Otetelişnau, states that, during the reorganization period following the World War, the great experience and competence of the former director was of the utmost value to the Roumanian service.—*C. L. M.*

METEOROLOGICAL STATIONS IN THE ARCTIC.

Supervising Forecaster E. H. Bowie, writing in the Philadelphia *Public Ledger* of November 15, 1922, concerning the establishment of a chain of meteorological stations in the Arctic says:

Stations are already in operation in Spitzbergen, Iceland, Jan Mayer (east of Greenland), and Alaska, from which regions daily reports are received by radio. The Amundsen Arctic exploration steamship *Maud*[1] is another link in the chain of outposts in the far north.

Steps already have been taken to establish additional radio equipments and weather observatories in Greenland and Baffin Land; later, it seems probable, outposts will be operated in north central Canada and the north shore of Alaska; and eventually the chain of outposts will encircle the North Pole, along the Arctic Circle.

THE SUN'S ACTIVITY, 1890-1920.

[Reprinted from *Nature* (London), September 30, 1922, pp. 465-466.]

The sun, as is well known, is a variable star having a period of approximately 11 years, but, unlike other stars, its variability can be determined from several different visible phenomena and not solely from the total integrated

[1] Cf. this REVIEW, February, 1922, 50:74.

light emitted. As classed among stars, it is not considered, however, as a regular variable, because the approximate period of 11 years is itself made variable through other minor periods of various lengths.

Though the sun has a dominating action on many terrestrial phenomena, authorities differ as to the exact relation between the pulsations of the two bodies. It is important, therefore, always to keep in mind, so far as possible, the actual state of solar activity at the moment, i. e., whether the sun is in a quiescent state through lack of spots and prominences, or whether it is in a very turbulent condition caused by their abundance.

The data for determining the state of the activity of the sun are published separately year by year in various volumes from different sources, and are only brought

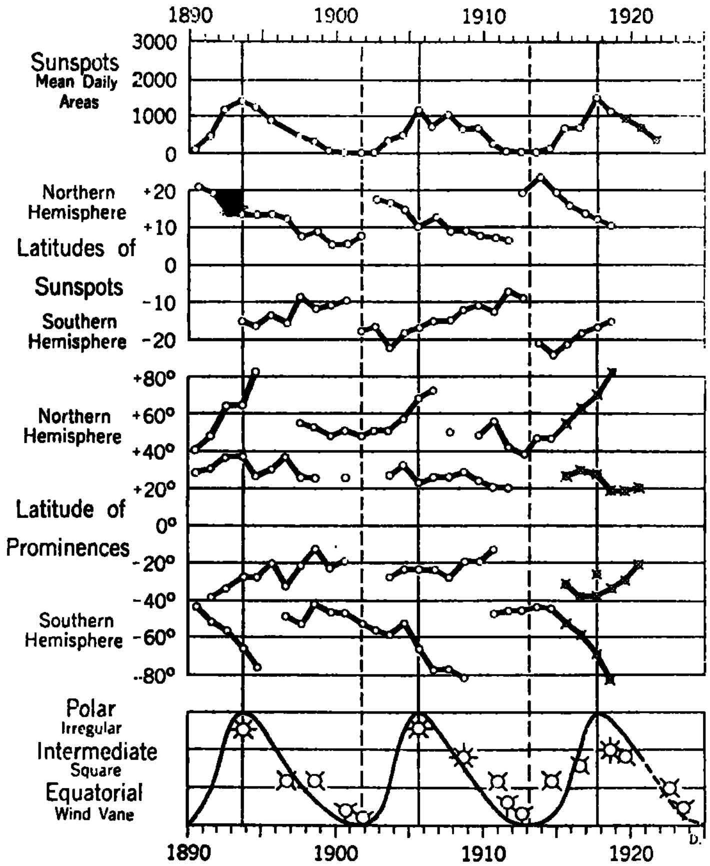

FIGURE 1.

together, probably with some difficulty, by research workers who wish to use them for particular inquiries.

Dr. W. J. S. Lockyer has recently coordinated the solar data regarding the sunspotted area, the latitudes of the activity zones of sunspots and prominences, together with the variations in the form of the corona for the period 1920 *to as near the present as possible*. The accompanying diagram (fig. 1) illustrates the solar changes in graphic form. The following paragraphs deal briefly with each set of curves individually, including the sources of the data:

Mean daily areas of sunspots.—Each of the points in the curve represents the mean of the daily areas of sunspots corrected for foreshortening for each year. The values are published by the Astronomer Royal yearly in the Monthly Notices of the Royal Astronomical Society, the last value published being that for 1918 (vol. 82, p. 485). The three later years marked with crosses are only provisional values.

It will be seen that the maximum spot activity occurred in the years 1893, 1905, and 1917, while the years of minimum were 1901 and 1913. The next minimum will probably fall in 1924 or 1925.

Latitudes of sunspots.—Under this heading there are two sets of curves—one for the northern and the other for the southern hemisphere of the sun. Each point represents the mean heliographic latitude of all spots for each hemisphere throughout the whole year. The data are taken from the same sources as mentioned above. It will be noticed that a new sun-spot cycle is always heralded by outbursts of spots in zones of high latitudes (about 22°), while the zone of spots nearer the equator is dying out.

Latitudes of prominences.—Here also there are two sets of curves, one for each hemisphere; where in the case of the spots there was only one zone for each hemisphere, for prominences there are two zones. Each point in the curves represents the mean latitude of each zone throughout the year. It will be noticed that in each hemisphere the zone in lower latitudes gradually approaches the equator, dying out just before or at sun-spot minimum, while the zone further away from the equator increases its latitude rapidly and dies out at or a little after sunspot maximum. The data up to 1914 are published in the Memoirs of the Kodaikanal Observatory (vol. 1, part ii) by Mr. John Evershed, and the remainder have been extracted from that observatory's bulletins published half yearly, from which the mean yearly latitudes of the zones have been provisionally determined by Doctor Lockyer.

The forms of the corona.—The last curve shows the condition of activity of the sun as indicated by the form which the corona takes when seen at total eclipses.

When the corona (polar form) exhibits streamers all around the solar disc, i. e., in all solar latitudes, this indicates a very turbulent state of the solar atmosphere and a time therefore of maximum activity. At this time the prominences reach their highest latitudes. When the streamers are confined to the equatorial regions and the poles are quite clear and void of streamers, the corona takes an "equatorial" or "wind-vane" form, and the solar activity is at a minimum. Intermediate stages are indicated by the corona taking an "intermediate" or "square" shape. The various forms of the corona are indicated clearly in the curve by three different symbols. The curve also shows the forms expected in the two approaching eclipses, namely, of this and of next year. The form for the present year will be of the "intermediate" type, while that for 1923 should be typical of the "equatorial" type. The data for the various forms of the corona have to be obtained from the individual reports of eclipse expeditions, but those to which reference has here been made have been collected by Doctor Lockyer and published in the Monthly Notices of the Royal Astronomical Society (vol. 82, p. 326).

All the solar phenomena described above thus indicate clearly that the activity of the sun is decidedly on the wane, and that the epoch of minimum disturbance in the solar atmosphere is approaching and will be reached in the year 1924 or 1925.